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72
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/927,779	08/09/2001	Michael L. Roukes	45129/RAG/C766	5454
23363	7590	02/09/2005	EXAMINER	
CHRISTIE, PARKER & HALE, LLP			LAM, ANN Y	
PO BOX 7068			ART UNIT	
PASADENA, CA 91109-7068			PAPER NUMBER	
			1641	

DATE MAILED: 02/09/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/927,779

Applicant(s)

ROUKES ET AL.

Examiner

Ann Y. Lam

Art Unit

1641

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
 - If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
 - If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
 - Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 01 November 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-32 is/are pending in the application.
- 4a) Of the above claim(s) 27-32 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-26 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>10/04, 6/03, 4/02, 10/01</u> | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Election/Restrictions

1. Applicant's election of Group 1 (claims 1-26) in the reply filed on November 30, 2005 is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)).

Claims 27-32 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 1-26 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The preamble in claim 1 recites "for detecting single-molecules". However, it is not clear in the body of the claims as to how the detection of single-molecules is related to the biofunctionalized resonator.

Also, it is not clear in claim 8, as to whether or not the "at least two resonators" in lines 1-2 of claim 8 is in addition to the resonator in claim 1, line 4.

Likewise, it is not clear in claim 9, as to whether or not the "at least three resonators" in lines 1-2 of claim 9 is in addition to the resonator in claim 1, line 4.

As to claims 23-26, it is not clear as to what is biofunctionalized. (For examination purposes, Examiner will assume that Applicant intended to mean that the resonator is biofunctionalized.)

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 1, 2, 4, 11, 12, 23, 25 and 26 are rejected under 35 U.S.C. 102(b) as being anticipated by Charych et al., WO 98/50773.

Charych et al. discloses a molecular detector for detecting single-molecules in solution comprising;

a solution reservoir (col. 11, line 9);

at least one biofunctionalized (page 8, lines 1-2) nanometer-scale mechanical resonator (10, including 50, page 8, line 1) disposed within the reservoir;

a detector (page 9, lines 5-11) in signal communication with the at least one resonator for measuring the mechanical displacement of the resonator (page 9, lines 5-11).

As to claim 2, the at least one resonator comprises a vibrational resonator (page 8, lines 11-14, and page 9, lines 5-11).

As to claim 4, the at least one resonator is biofunctionalized with a receptor (page 8, lines 1-2).

As to claim 11, the at least one resonator is made from silicon (page 4, line 11).

As to claim 12, the detector is integral with the resonator (page 4, lines 13-14, and page 8, lines 12-14).

As to claims 23, the resonator is biofunctionalized to detect a receptor/ligand interaction (page 12, lines 3-7).

As to claim 25, the resonator is biofunctionalized to detect a chemical bond (page 12, lines 3-7).

As to claim 26, the resonator is biofunctionalized to detect protein unfolding (page 12, lines 3-7).

4. Claims 1-4, 11, 13, 15-17, 23, 25 and 26 are rejected under 35 U.S.C. 102(b) as being anticipated by Thundat et al., 6,289,717.

Thundat et al. discloses a molecular detector for detecting single-molecules in solution comprising;

a solution reservoir (col. 4, line 47, and col. 6, lines 55-56);

at least one biofunctionalized (col. 4, lines 4-5) nanometer-scale (col.3 , lines 54-60) mechanical resonator (3) disposed within the reservoir;

a detector (col. 5, lines 6 or 16-19) in signal communication with the at least one resonator for measuring the mechanical displacement of the resonator.

As to claim 2, the at least one resonator comprises a vibrational resonator (3).

As to claim 3, the resonator is a notched vibrational cantilever (see fig. 2).

As to claim 4, the at least one resonator is biofunctionalized with a receptor (col. 4, lines 4-5).

As to claim 11, the at least one resonator is made from silicon (col. 4, line 4).

As to claim 13, the detector is a piezoresistive transducer (col. 5, line 17).

As to claim 15, the detector is an optical detector (col. 5, line 6).

As to claim 16, the detector is a lock-in detector (i.e., a piezoresistive transducer, col. 5, line 17.) (Applicant's disclosure of a lock-in detection scheme is on page 20 of the specification. The detector disclosed by Thundat et al. is capable of performing this function.)

As to claim 17, the resonator has a thickness between about 10 nm and 1 μ m (col. 3, line 57), a width between about 10 nm and 1 μ m (col. 3, line 57), and a length between about 1 μ m and 10 μ m (col. 3, line 56.)

As to claims 23, the resonator is biofunctionalized to detect a receptor/ligand interaction (col. 4, lines 32-38.)

As to claim 25, the resonator is biofunctionalized to detect a chemical bond (col. 4, lines 32-38).

As to claim 26, the resonator is biofunctionalized to detect protein unfolding (col. 4, lines 32-38).

5. Claims 1-4, 11 and 24 are rejected under 35 U.S.C. 102(b) as being anticipated by Fritz et al., "Translating Biomolecular Recognition into Nanomechanics", Science, 14 April 2000, pages 316-319, Vol. 288.

Fritz et al. discloses a molecular detector for detecting single-molecules in solution comprising;

a solution reservoir (page 317, first partial paragraph);

at least one biofunctionalized (page 317, first column) nanometer-scale (page 318, last paragraph) mechanical resonator (cantilever, page 318, last paragraph) disposed within the reservoir;

a detector (page 316, second paragraph) in signal communication with the at least one resonator for measuring the mechanical displacement of the resonator.

As to claim 2, the at least one resonator comprises a vibrational resonator (page 317, first full paragraph).

As to claim 3, the resonator is a notched vibrational cantilever (see fig. 2 on page 317).

As to claim 4, the at least one resonator is biofunctionalized with a receptor (see fig. 2 on page 317).

As to claim 11, the at least one resonator is made from silicon (page 316, third paragraph, third sentence).

As to claim 24, the resonator is biofunctionalized to detect DNA hybridization (page 317, first column.)

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 13 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Charych et al., WO 98/50773, in view of Thundat et al., 6,289,717.

Charych et al. teaches the invention substantially as claimed (see above with respect to claim 1.) Additionally, Charych et al. teaches that the transducer is made of p+ doped silicon (page 6, line 31; the disclosed doped poly-silicon encompasses p+ doped silicon).

However, Charych et al. does not teach that the detector is a piezoresistive transducer. Charych et al. teaches that the detection is performed through detecting a voltage response due to a chemical reaction which induces deformation of the cantilever (page 9, lines 5-11.) Charych et al. however is silent as to the particular type of detector.

Thundat et al. however teaches that a piezoresistive detector, as an alternative to other detection means such as piezoelectric detection means or capacitive detection means, can be used to detect deformation of a cantilever due to a binding reaction on the cantilever (col. 5, lines 16-17, and col. 4, lines 5-9.) It would have been obvious to

Art Unit: 1641

one of ordinary skill in the art at the time the invention was made to utilize a piezoresistive detector taught by Thundat et al. as the detection means in the Charych et al. device since Thundat et al. teaches that a piezoresistive detector is a known alternative detection means to detect deformation of a cantilever such as that disclosed by Charych et al.

7. Claims 18-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Charych et al., WO 98/50773.

Charych et al. discloses the invention substantially as claimed (see above with respect to claim 1.)

However, Charych et al. does not disclose that the resonator has a resonance motion vacuum frequency between about 0.1 and 12 MHz (claim 18), nor a force constant between about 0.1mN/m and 1N/m (claim 19), nor a Reynolds number between about 0.001 and 2.0 (claim 20), nor a mass loading coefficient between about 0.3 and 11 (claim 21), nor a force sensitivity of about $8\text{fN}/\sqrt{\text{Hz}}$ or greater (claim 22).

It has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233. In this case, Charych et al. discloses the general conditions of the claims (see above with respect to claim 1), and the ranges recited in claims 18 through 22 relate to optimum or workable ranges and thus involve only routine skill in the art according to *In re Aller*.

Allowable Subject Matter

8. Claims 5-10 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ann Y. Lam whose telephone number is 571-272-0822. The examiner can normally be reached on M-Sat 11-6:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Long Le can be reached on 571-272-0823. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Application/Control Number: 09/927,779

Page 10

Art Unit: 1641

A.L. 



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2/7/05